Transition funding for the Shallow Water Integrated Mapping System (SWIMS) and Modular Microstructure Profiler (MMP)

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Grant Number: N00014-12-1-0917
http://wavechasers.ucsd.edu/

LONG-TERM GOALS

I am interested in the general problems of internal waves and ocean mixing. Knowledge of these is important for advancing the performance of operational and climate models, as well as for understanding local problems such as pollutant dispersal and biological productivity. SWIMS and MMP are valuable, highly capable instruments that will enable me to participate in many future ONR initiatives, complementing my other suite of moored profiling instruments.

OBJECTIVES

- Transition the Shallow Water Integrated Mapping System (SWIMS) and Modular Microstructure Profiler (MMP) instrumentation from Mike Gregg's group to mine.

APPROACH

Shallow Water Integrated Mapping System (SWIMS) Towed behind a ship, SWIMS is winched up and down from the surface to about 500-600 m depending on tow speed, which can range from 0-6 knots. It carries up and downlooking ADCP's, two pumped CTD's, optical backscatter, and a newly de- veloped temperature microstructure package (χ-ometer). The velocity measurements obtained from SWIMS are substantially better than those obtained from a shipboard ADCP because they can get much closer to the bottom. Additionally, SWIMS allows tighter sawtooths than similar undulating bodies such as Triaxus and Seasoar, and can be operated much closer to steep topography.

Modular Microstructure Profiler (MMP) is a loosely tethered microstructure profiler that carries a pumped CTD, and shear probes and FP07 thermistors for velocity and temperature microstructure. With a noise floor near 10−10 W kg−1, it is one of the most sensitive microstructure instruments available. It is deployed from the stern of the ship with a twisted-pair cable, requiring a team of three people per shift to operate. MMP can be operated in time series or along transects, providing repeated profiles of dissipation, diffusivity and buoyancy flux. Profiles to 300 m can be done every 15-20 minutes. Dissipation rates are calculated from shear probe data using standard techniques. Importantly,

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE **30 SEP 2014**	2. REPORT TYPE	3. DATES COVERED **00-00-2014 to 00-00-2014**

4. TITLE AND SUBTITLE **Transition funding for the Shallow Water Integrated Mapping System (SWIMS) and Modular Microstructure Profiler (MMP)**	5a. CONTRACT NUMBER 5b. GRANT NUMBER 5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER 5e. TASK NUMBER 5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **University of California San Diego,Scripps Institution of Oceanography,9500 Gilman Drive,La Jolla,CA,92093**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR’S ACRONYM(S) 11. SPONSOR/MONITOR’S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**3**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

MMP uses pumped conductivity probes, unlike most other microstructure profilers, giving much better precision in salinity estimates.

WORK COMPLETED

Thanks to a related grant to study Washington coast internal waves, we have transitioned MMP and SWIMS to Scripps. We first needed to repair one of the MMP's, which had a slight leak. We successfully operated both of these instruments during our August 2014 cruise.

RESULTS

We observed beautiful breaking lee waves in repeated alongchannel transects over a sill in the canyon (Figure 1). We wrote these measurements up in a GRL note.

TRANSITIONS

These instruments were developed at APL/UW by Mike Gregg. Following his wishes, they are now at Scripps with me, and will be operated by my group here.

RELATED PROJECTS

SWIMS and MMP were used in our Washington coastal nonlinear internal waves project.

PUBLICATIONS

Matthew H Alford and Parker MacCready. Flow and mixing in Juan de Fuca Canyon, Washington. *Geophys. Res. Lett.*, 41:1–8, 2014.

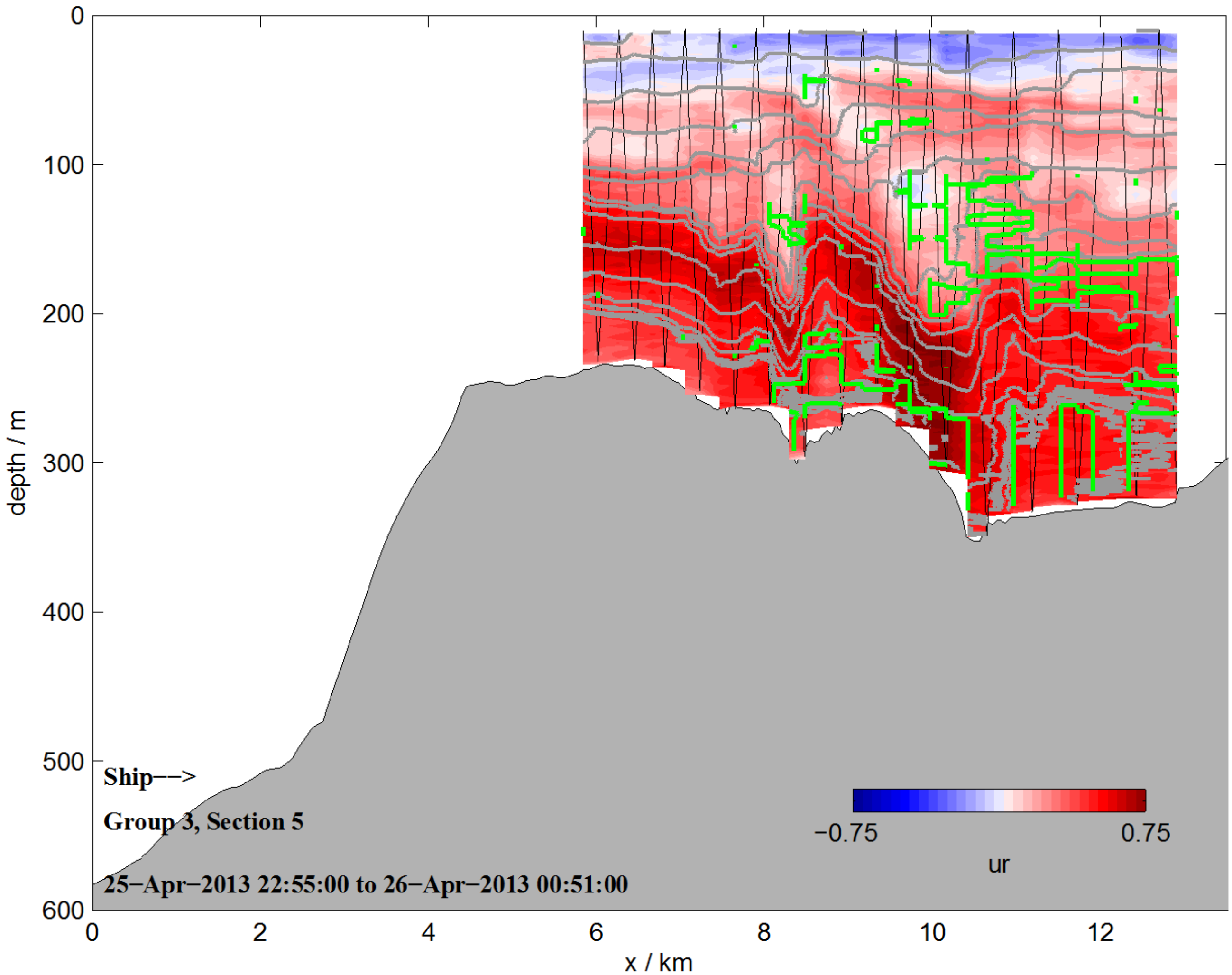

Figure 1: Alongcanyon velocity from a one-hour tow from left to right with SWIMS over a sill in Juan de Fuca submarine Canyon, Washington. Flow is strongly accelerated transiting the sill at km 6, reaching over 75 cm/s as it descends. Internal lee waves are seen near km 8 and 11, whose breaking gives rise to strong turbulence (estimated from Thorpe scales; green contours indicate $\varepsilon > 10^{-6}$ W/kg). The sawtooth lines indicate SWIMS's track.